Appendix A - Equipment

How to Clean and Care for Equipment

Nets

To ensure that no contamination occurs between sampling sites, make sure that all nets and organism collection equipment have been cleaned of all organisms and matter. Be sure to rinse them thoroughly before transporting to another location.

Transparency Tube *(From Minnesota Citizen Stream Monitoring Program, "Stream Reader" Spring 2000)*

If you monitor a stream that is on the murky side, chances are the walls of your transparency tube have clouded up. Try cleaning the inside of your tube by filling it three-quarters full with tap water, add a couple drops of dish soap, and push a clean, soft rag or washcloth down the tube with the end of a broom handle, scrubbing the sides. If you take the stopper out of the bottom, be sure to fit it back into the tube securely.

If your tube has a release tube and valve, it may become crimped. Try moving the position of the clamp on your release valve from time to time, and fully release the clamp between uses. By doing this, the tube won't break down and get crimped in any one spot.

E.coli Testing Supplies

Store bottles of Coliscan Easygel in the freezer for up to one year. Do not freeze pre-treated petri dishes.

Chemical Testing Kits

Do not store in kits in your car or anywhere they would experience extreme hot or cold temperatures. Bright light degrades the reagents in the CHEMetrics ampoules and color standards - do not leave them open in sunlight or indoors. Be sure to triple rinse bottles & tubes with distilled water immediately following tests to avoid staining and contamination, and always triple rinse with sample water before taking a stream sample.

Be sure your chemicals, test strips, and color standards are not expired! CHEMetrics color standards are good for 2 years, Water Works pH test strips are good for 2 years, and the Nitrate/Nitrite test strips expire after 20 months.

Resupply Policy

You may receive replacement chemical testing supplies (pH strips, nitrate/nitrite strips, CHEMetrics ampoules and color standards) from Hoosier Riverwatch if you meet the following criteria:

- You have registered yourself and at least one sampling site in the Hoosier Riverwatch on-line database (www.HoosierRiverwatch.com)
- You have submitted at least four sets of data to the on-line database within the last year.
- You are current and up-to-date on your submissions of quarterly activity reports to Hoosier Riverwatch (if you received supplies from us through the Equipment Application program).

If you meet these criteria and wish to obtain a one-year supply of updated chemical testing materials, please visit the Hoosier Riverwatch website (http://riverwatch.in.gov) and download a copy of the Supply Request Form or contact us to request a copy. You can mail or e-mail the completed form to Hoosier Riverwatch.

Equipment for Water Quality Monitoring

The following supplies may be useful in monitoring the water quality of your local river or stream:

Site Assessment

- ❑ Maps (e.g., 7.5" topographic map, assessor's map indicating property boundaries) and aerial photos
- ❑ Compass and survey tape for marking boundaries
- ❑ Clipboard, writing utensils, and laminated copies of chemical, biological, and habitat data sheets
- ❑ Tape measure or twine marked in one-meter/foot lengths
- ❑ Stopwatch for measuring stream flow
- ❑ Apple, orange, or other biodegradable object that can be floated to measure stream flow
- ❑ Yardstick or other device to measure depth

Biological Assessment

- ❑ Kick seine net, dip net, shovel, or other tools for collecting benthic macroinvertebrates
- ❑ Sieve and trays for sorting biological samples (ice cube trays work well for sorting organisms)
- ❑ Tweezers, hand lens, magnifying glass, and possibly a microscope
- ❑ Glass vials or jars filled with isopropyl alcohol or white vinegar for storing insects (if so desired)
- ❑ Handmade Hester-Dendy substrate sampler or GREEN Leaf-pack bags to use in waterways too deep to enter on foot

Chemical Assessment

- ❑ Chemical water quality testing equipment will vary with the type of monitoring you wish to pursue. Some of the tests most commonly performed include dissolved oxygen, *E*.coli, pH, BOD, water temperature change, total phosphates, nitrates, turbidity, and total solids. Equipment for each test will vary in range, sensitivity, and cost depending on the use of chemical or electronic materials.
- ❑ If using an electronic pH meter, need pH buffer and a small screwdriver for calibrating.
- ❑ Handmade extension sampling rod (See page A-8.)
- ❑ Distilled water for rinsing sampling bottles and tubes
- ❑ Secchi disk or handmade turbidity tube
- ❑ Container with kitty litter for liquid waste (if using hazardous chemicals, need separate waste container)
- ❑ Material Safety Data sheets for every chemical being used

Safety

- ❑ Throw bag, life preserver or rope
- ❑ Rubber boots, hip boots or waders (WARNING: Never put children in chest-high waders because they can fill with dangerous amounts of water if submerged.)
- ❑ Rubber gloves and protective eyewear
- ❑ First Aid kit that includes eyewash
- ❑ Washing water, antibacterial soap, and a towel
- ❑ Insect repellent

Other Supplies

- ❑ Drinking water
- ❑ Camera for documenting site
- ❑ Trash bags or other waste containers for a streambank clean-up
- ❑ Card table
- ❑ Calculator
- ❑ Computer and Internet access for entry of water quality data

Where to Purchase Equipment

CHEMICAL TESTING KITS

CHEMetrics

(800) 356-3072 , *www.chemetrics.com*
Ordering Code: "IG" (Use when ordering)

	Dissolved Oxygen	Phosphate
Full kit	K-7512 = $32.18	K-8510 = $33.73
Ampoules	R-7512 = $16.13	R-8510 = $16.13
Standards	C-7512 = $11.03	C-8510 = $11.03 (high-range) C-8501 = 7.65 (low-range)

Water Works Test Strips/Industrial Test Systems

(800) 861-9712, *www.sensafe.com*
* pH - $10/bottle of 50 #481104 (good for 24 months)
- $10/pk of 30 indiv-wrapped #480104 (20 mo.)
*Nitrate - $15/bottle of 50 #480009 (good for 18 mo.)
- $15/pk of 30 indiv-wrapped #481109 (12 mo.)

Earth Force/GREEN

(703) 519-6877, *www.earthforce.org*
*GREEN Standard Kit = $105 (for special Hoosier Riverwatch version w/out bacteria) #XX00799
**Protecting Our Watersheds* = $65.00
*Bug sorting sheets (6) #5882-SS6 = $28.30
*GREEN Low-Cost Kit #5886 = $29.95

Hach Company

(800) 227-4224, *www.hach.com*
* Stream Survey Kit #27120-00 = $269.10
* 500 mL wash bottle #620-11 = $4.70
* Combined Standard (N & P) # 2833049 = $25.90
* Nitrate Standard (1 mg/L) #2046-49 = $14.20
* Phosphate Standard (1 mg/L) #2569-49 = $14.30

2-Way Bug Viewer (#IN352077) $7.95

ETA Cuisenaire: (800) 445-5985

Macroinvertebrate ID Cards (#ICS) $4/set

Illinois Natural History Survey: (217) 333-6833

DIP NETS

Nichols Net and Twine Co.
(800) 878-6387
* Stream Monitor Kick Seine
* Aquatic Dip Net (Like "D"-net)

KICK NETS

Gary L. Keehn
(785) 834-2075
* Yellow Kick Seine Net
$30.00

BACTERIA INCUBATOR

Hova-Bator
(912) 236-0651
www.gqfmfg.com
Mfg#: 1602N - $43.95

TRANSPARENCY TUBES

Lawrence Enterprises
(207) 276-5746
* Transparency Tubes
60 cm tube for $34.00

E-COLI TEST KITS

Micrology Laboratories
(888) EASYGEL
www.micrologylabs.com
* E-coli test kit- EASYGEL

Easygel /Petri dish (#25001)
$18.50 pkg. of 10
1ml pipette(#DRP01) $.12 ea
3ml pipette(#DRP03) $.14 ea

BOOKS and MANUALS

McDonald & Woodward Publishing
(800) 233-8787
**Guide to the Freshwater Macro-invertebrates of North America*
by Voshell, J. Reese

Jones and Bartlett Publishers
(800) 832-0034
**Aquatic Entomology*
by McCafferty, Patrick

U.S. EPA - OWOW
(800) 490-9198
**Volunteer Stream Monitoring Methods Manual*
Doc. #841B97003 (FREE!)

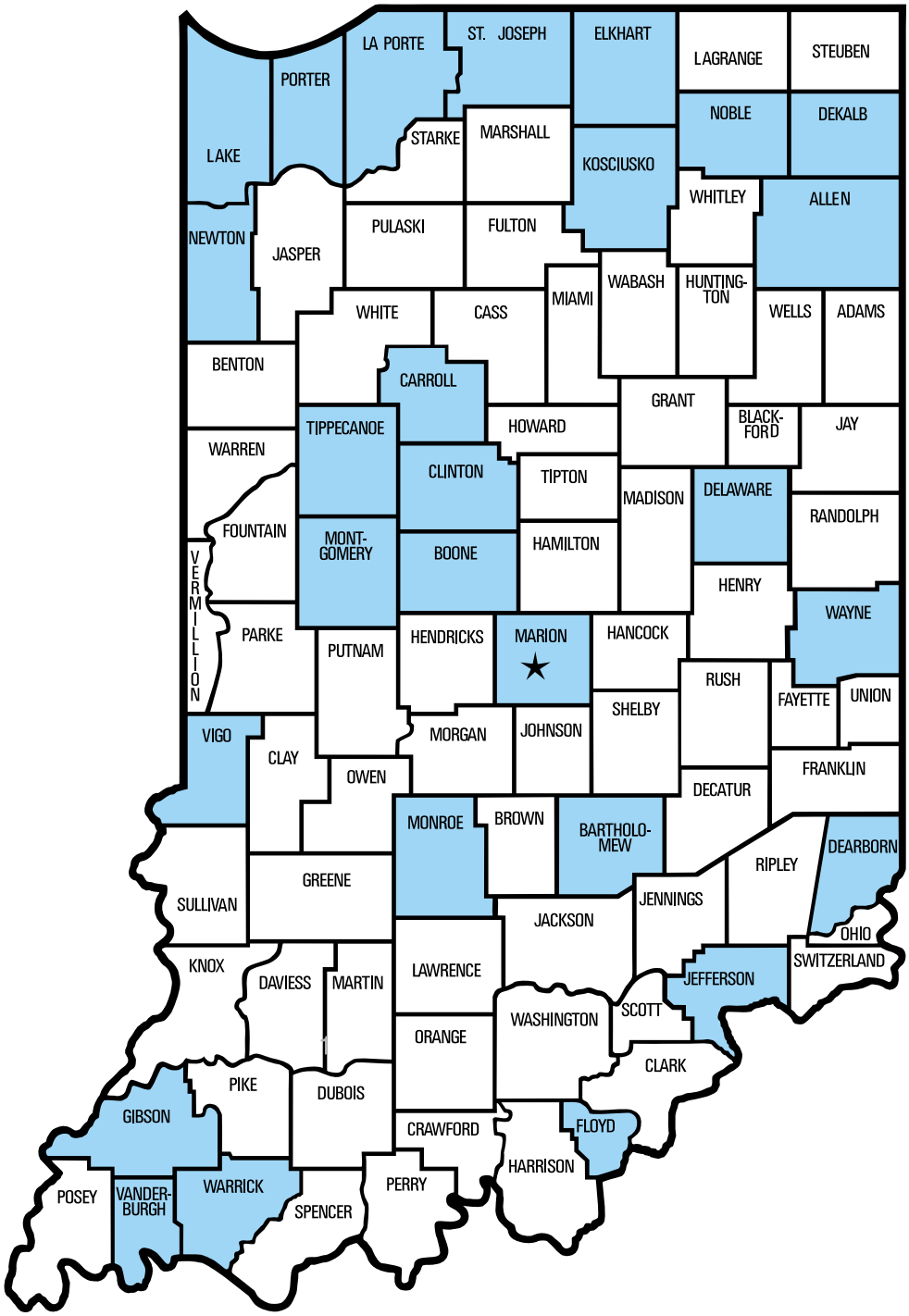
OTHER ENVIRONMENTAL SCIENCE SUPPLIERS (Call to request catalog)

Ben Meadows	(800) 241-6401	Forestry Suppliers, Inc.	(800) 647-5368
Bioquip Products	(310) 324-0620	Wards Biological	(800) 635-8439
Carolina Biological	(800) 344-5551	Wildlife Supply Co.	(517) 799-8115

This list contains just a few of the many science equipment suppliers available. It is not intended to be an endorsement of any product or company. Prices are as of 2005 and are subject to change.

Hoosier Riverwatch Loaner Equipment Sites

Water Monitoring Equipment is available from 25-30 loaner sites to certified Volunteer Riverwatchers in Indiana. This map is a draft plan for locations as of 2005.



Riverwatch Volunteer Water Monitoring Instructors are located in many of these same counties. Visit the Riverwatch website [www.Riverwatch.in.gov] for contact information and additional details.

How to Make Your Own Equipment

Not all of your water monitoring equipment has to be purchased through a catalog or at a store. Nets and other sampling supplies can be made at home.

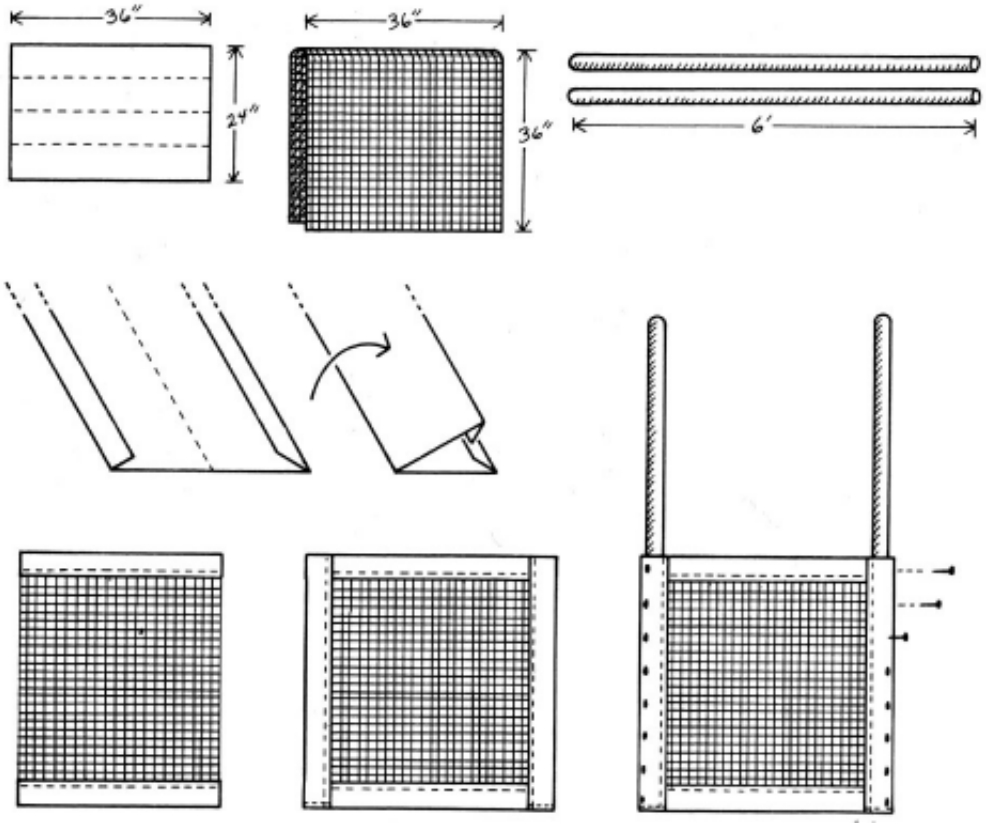
Kick Seine Net #1

Materials:

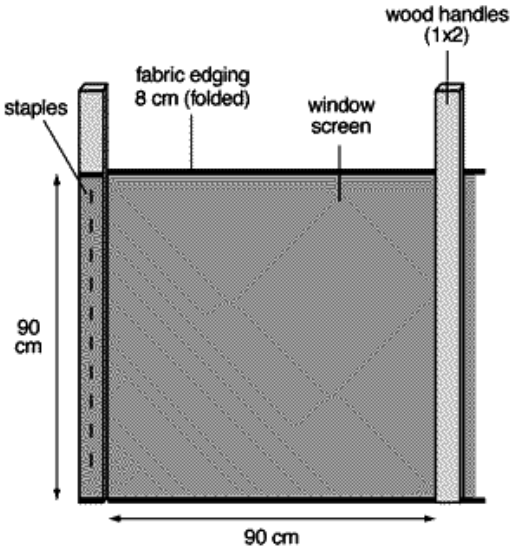
- 3 foot by 6 foot piece of nylon or fiberglass screening (white, if you can find it)
- 4 strips of heavy canvas (6 inches by 36 inches)
- 2 broom handles or wooden dowels (6 feet long)
- finishing nails
- sewing machine and thread
- hammer
- iron and ironing board

Directions:

1. Fold screening in half (3 foot by 3 foot).
2. Fold edges of canvas strips under 1/2 inch and press with iron.
3. Sew 2 strips at top and bottom of screening, then use remaining 2 strips on the sides of the screening to make casings for handles. Sew bottom of casings shut.
4. Insert handles into casings and nail into place with finishing nails.

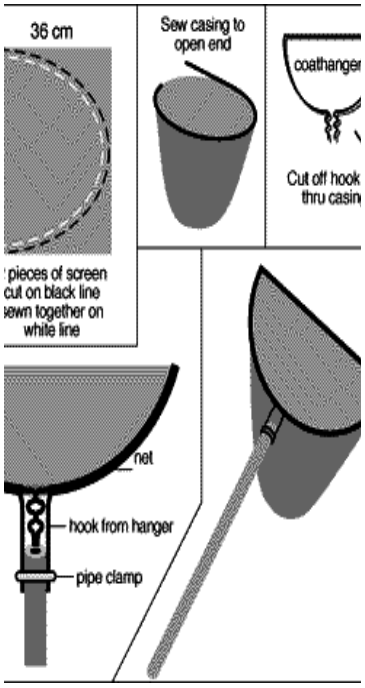


Kick Seine Net #2



Directions:

1. Fold one 8 x 122 cm strip of fabric over one of the long screen edges and sew, reinforcing the edge.
2. Repeat for the other long edge.
3. Attach screen to poles with stapes, making the poles even with the bottom of the screen and extending to form handles at the top.
4. Wrap screen around poles several times and staple again to reinforce the edges.



Dip Net

Directions:

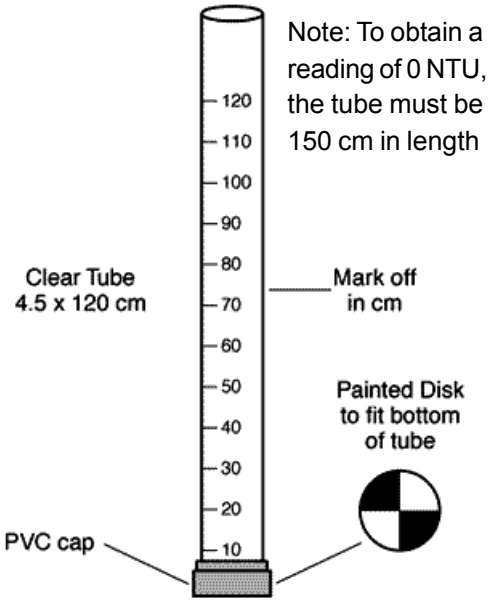
1. Cut a net shape from the 36 x 53 cm pieces of nylon screen and sew them together.
2. Edge the open end of the net with heavy fabric, leaving an opening to form a casing to insert the hanger.
3. Cut hooks from hangers and untwist the wires.
4. Use duct tape to tape the hangers together to make your frame heavier.
5. Insert a wire through the casing and twist ends back together at opening.
6. Drill a hole in the tip of the wooden handle large enough to insert the ends of the hangers into the hole in the pole. Secure the net to the pole by using the hook you cut from the hanger and using the pipe clamp or duct tape to secure the hook to the pole.

Transparency Tube

For instructions on how to correctly use the transparency tube see Chapter 4 Chemical Monitoring.

Directions:

1. Put a PVC cap over one end of a clear tube (a florescent light bulb tube cover works great). Cap should fit tightly so water cannot leak out. A rubber stopper also works.
2. Cut a disk from wood or plastic the same size as the tube diameter.
3. Divide the disk into four quadrants. Paint the alternating quadrants black and white. Seal the disk by laminating or painting with varnish to make it waterproof.
4. Glue the disk in the bottom of the tube, painted side facing up (toward the open end of the tube).
5. Use a marker and meter stick to make a scale on the side of the tube, beginning at the disk with 0 cm. Or mark on a piece of tape and stick it to the outside of the tube.



Underwater Viewer

The underwater viewer can be used in shallow and slow moving streams to view under the surface.

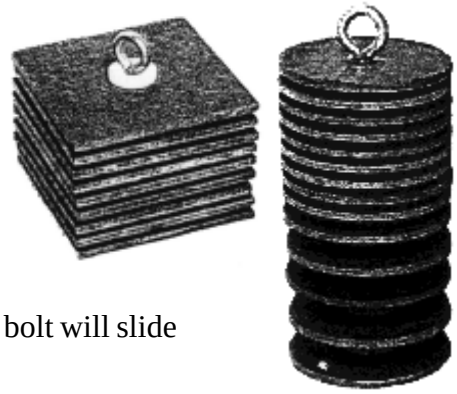
Materials:

- ❑ Large metal coffee can with both ends cut out
- ❑ Plastic food wrap
- ❑ Large rubber bands

Directions:

1. Stretch the plastic food wrap tightly over one end so that it is tight and smooth.
2. Secure the wrap with a rubber band, tape the rubber band to hold it securely in place.

Hester-Dendy Artificial Substrate Sampler



Materials:

- ❑ Nine 3 x 3 inch Masonite plates (hardest and most water resistant grade)
- ❑ Nylon spacers
- ❑ Stainless steel eye-bolt extra long

Directions:

1. Drill a hole in the middle of each masonite plate, so that the eye bolt will slide through each plate.
2. Place a nylon spacer between masonite plates.
3. Insert the eye bolt through the plates and the spacers (see diagram). The width between each masonite plates can be varied by adding more spacers.

Extension Sampler

(The following instructions were provided by John Rouch, Past-President of Water Watchers of Indiana.)

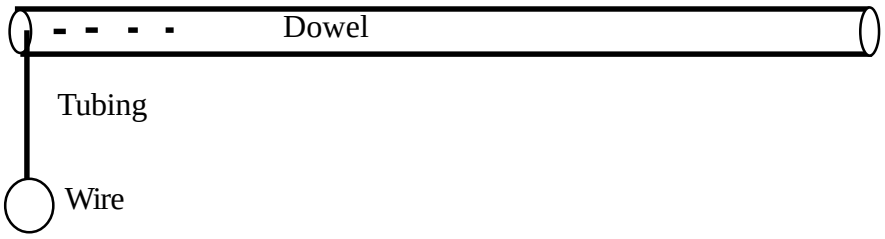
An extension sampler may be helpful for collecting stream water at monitoring locations where the water can not be entered into directly (e.g., too deep, too fast , or too polluted).

Materials:

- ❑ 4-6 foot dowel rod, 1/2 inch or more in diameter
- ❑ rubber inner tube, cut into 12 inch by 3 inch strips
- ❑ 6 inch length of picture framing wire (or other flexible wire)
- ❑ 6 small nails

Directions:

1. Nail the rubber tubing to the end of the dowel.
2. Hook the wire onto the end of the tube so that the wire forms a circle (see diagram below).
3. Nail the remaining four nails along the dowel so that the rubber tubing can secure different sizes of bottles for water collection.



For use:

Secure the sampling container against the dowel rod by wrapping the tube around the container and hooking the wire loop around one of the nails.

APPENDIX B

Macroinvertebrate Adults Key

GROUP 1 – Young are Very Intolerant of Pollution

Stonefly Adult

Mayfly Adult

Riffle Beetle Adult

Caddisfly Adult

Dobsonfly Adult

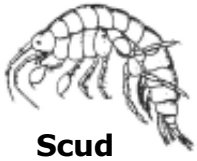
Water Penny Adult

Right-Handed Snail

GROUP 2 – Young are Moderately Intolerant of Pollution

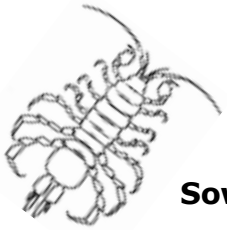
Damselfly Adult

Dragonfly Adult



Scud

Crayfish



Sowbug

Cranefly Adult

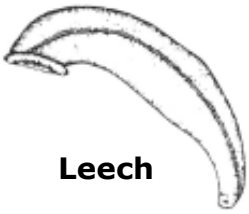
Clam/Mussel

GROUP 3 – Young are Fairly Tolerant of Pollution

Midge Adult

Planaria

Black Fly Adult



Leech

GROUP 4 – Young are Very Tolerant of Pollution

Aquatic Worms

Left-Handed Snail

Hoverfly
(Rat-tailed maggot adult)

Blood Midge Adult

APPENDIX C

What Can You Do To Prevent Water Pollution?

"A man who is willing to undertake the discipline and difficulty of mending his own ways is worth more to the conservation movement than a hundred who are insisting merely that the government and the industries mend their ways."

~ Wendell Berry

At Home

- Properly dispose of household chemicals such as paint and cleaners at the local hazardous waste center (do NOT pour down sink or storm drains!). Buy environmentally-friendly products: many safe yet effective cleaning solutions can be made from organic or non-toxic ingredients.
- Reduce the amount of solid waste you generate. Landfill space is becoming more scarce daily.
- Make sure you septic system is properly functioning.
- Wash your car at a car wash or in your lawn. Do not wash it in your driveway with dirt and detergents flowing down a storm drain and into a local waterway.

Water Conservation

- Repair leaky faucets and toilets right away.
- Turn off the tap while brushing your teeth and washing the dishes.
- Run the washing machine and dishwasher only when they are fully loaded.
- Sweep off instead of hosing the driveway, patio or sidewalk.
- Install water-saving showerheads and high-performance, low-flush toilets.
- Water your lawn and garden only in the morning or evening.

In the Yard/Garden/Field

- Discontinue or minimize fertilizer usage on lawns, crops, etc., or use organic fertilizers
- Test your soil to determine its nutrient needs before treating.
- Consider Integrated Pest Management principles (ask your Purdue Extension Educator)
  - Use the smallest amount of an appropriate pesticide at the proper time.
  - Encourage natural pest predators such as certain birds and harmless insects.

On the Road/On the Water

- Fix motor vehicle leaks to prevent oil, antifreeze and other fluids from dripping onto streets, driveways and parking lots. These chemicals will mix with rain to produce polluted runoff.
- Recycle used motor oil and antifreeze.
- Boats and engines should be properly cleaned or allowed to dry after leaving zebra mussel infested waters. Check boat trailer for any "weeds" or fragments of invasive aquatic plants.

Wetlands

Wetlands filter pollutants such as sediment and nutrient runoff. Wetlands hold water and reduce flooding. Healthy functioning wetlands can actually *reduce* mosquito populations.

- Protect and preserve existing wetlands.
- Restore and create wetlands for landscaping and wildlife habitat.
- Be an advocate for wetlands and educate others about their importance.

Best Management Practices (BMPs)

Agricultural and construction BMPs are systems or activities that are practiced to control and prevent erosion and nonpoint source pollution. They generally involve various combinations of the following approaches:

- Minimize mixing of rain and pollutants (e.g., animal waste management, fertilizer and pesticide/ herbicide management, integrated pest management).
- Restrict water runoff, thereby restricting transportation of pollutants
  - Porous pavement
  - Ground cover management
  - Conservation tillage is any tillage and planting system that covers 30% or more of the soil surface with crop residue after planting.
  - No-till leaves the soil undisturbed from harvest to planting except for nutrient injection - planting or drilling is accomplished in a narrow seedbed or slot created by special equipment. Weed control is accomplished primarily with herbicides
- Trap/collect pollutants to prevent them from entering waterbodies or groundwater
  - Silt fences
  - Detention sedimentation basins
  - Riparian buffer strips are streamside plantings of trees, shrubs, and grasses
  - Grassed waterways are strips of grass seeded in areas of cropland where water concentrates and flows off a field

s

Advocacy is the act of pleading for, supporting or recommending a cause or course of action. Becoming an advocate may require seeking out information about what laws exist and who is instrumental in deciding or enforcing those laws. Be sure you are well informed before pursuing a course of action. Get involved!

- To influence new or existing regulations, attend public comment meetings and participate in discussion (avoid opinionated comments, make articulate ones), write well-written letters, and/or arrange face-to-face meetings with rule makers (i.e. legislators, city/county council members, zoning board members).
- Participate in your neighborhood organization, watershed organization, land trust, local or state-wide river/stream/lake/wetland protection organization (or START one!)
- Participate in storm drain stenciling programs (or START one!)
- Arrange and/or sponsor public presentations by respected experts.
- Serve on a decision-making board or run for office.

For more information about what you can do, please check out the links on our website or contact the Hoosier Riverwatch office.

APPENDIX D

Chemistry Ranges, Averages and Q-Values

After each set of in Chapter 4 Chemical Monitoring are values representing the likely ranges into which your chemical test results may fall. These ranges were created by determining the level at two standard deviations around average concentrations from the US Geological Survey fixed stations throughout Indiana from the period 1991-2002. Each range statistically represents values found on roughly two-thirds of Indiana streams and rivers tested. One-third of Indiana streams would be expected to have values higher or lower than this range. In addition, the Indiana water quality standards for rivers are included for each applicable parameter.

Typical range for DO =
5.4 to 14.2 mg/L

Indiana Average = 9.8 mg/L

State Water Quality Standard:
Avg > 5mg/L, not < 4mg/L

Temperature Change
State Water Quality Standard:

< 5° F change downstream
(approximately 2.8° C)

< 2° F change for trout streams
(approximately 1.1° C)

Typical range for *E.* coli =
133 to 1,157 colonies/100 mL

Indiana Average =
645 colonies/100mL

State Water Quality Standard for total body contact recreation:

<235 colonies/100 mL (single sample),
AND
< 125 colonies/100 mL (Geometric mean of 5 samples equally spaced over 30 days)

There are no state water quality standards for Orthophosphate. However, we do know the **Total Phosphate** typical range (0 to 0.85 mg/L) and average (0.05 mg/L).

We generally expect orthophosphate to be less than total phosphate, since orthophosphate is but one component of total phosphate.

Typical range for pH = 7.2 to 8.8
Indiana Average = 8.0

State Standard = between 6 - 9

Due to the state's limestone geology, Indiana surface waters will typically have a pH that is relatively basic (> 7).

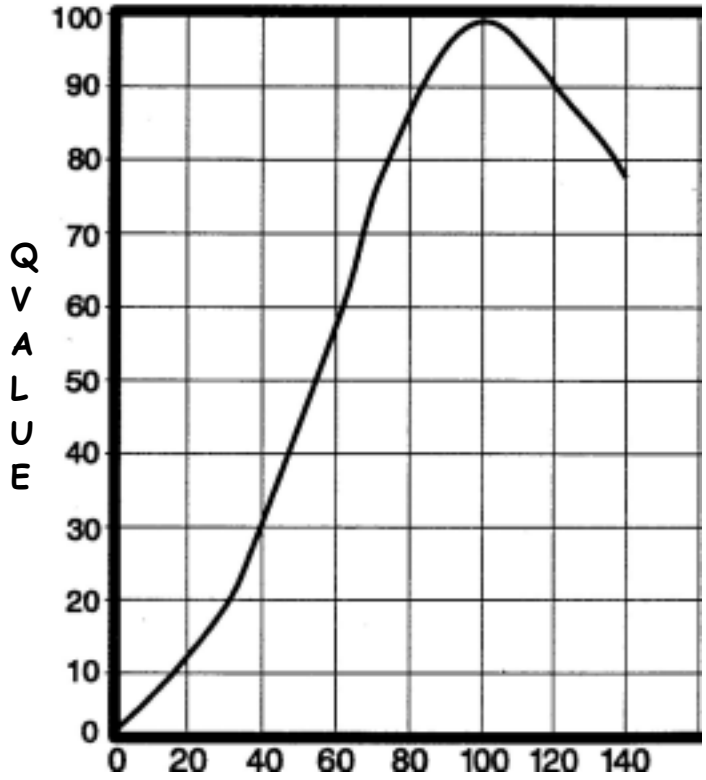
Typical range for NITRATE (NO_3) =
0 to 36.08 mg/L

Indiana Average = 12.32 mg/L

Typical range for BOD_5 =
0 to 6.3 mg/L
Indiana Average = 1.5 mg/L

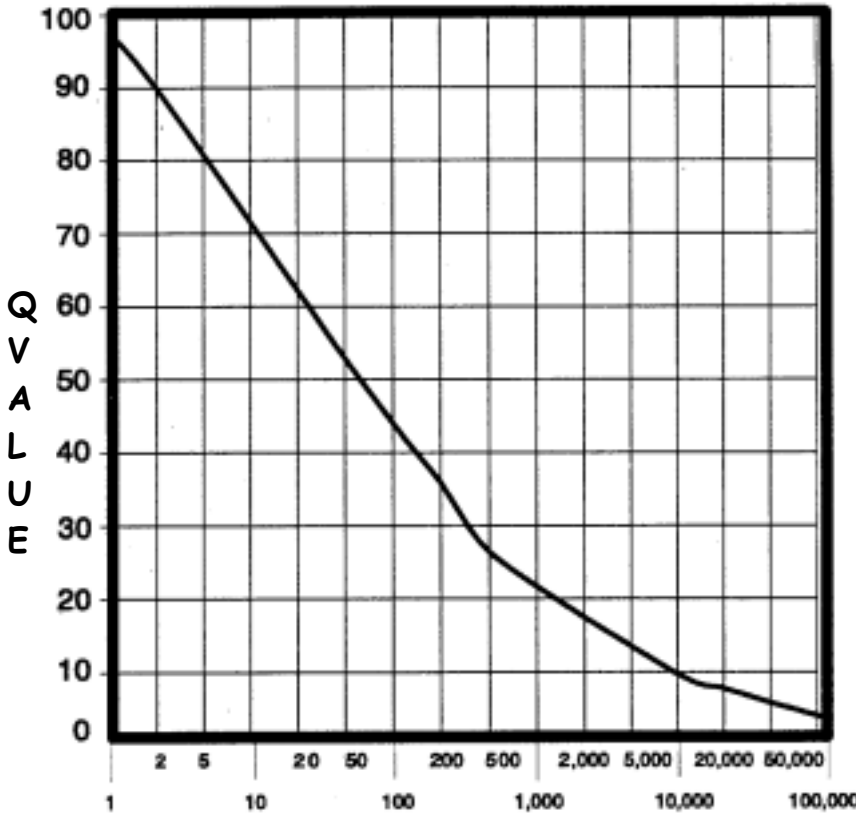
Typical range for TURBIDITY =
0 to 173 NTU
Indiana Average = 36 NTU

Dissolved Oxygen Q-Values



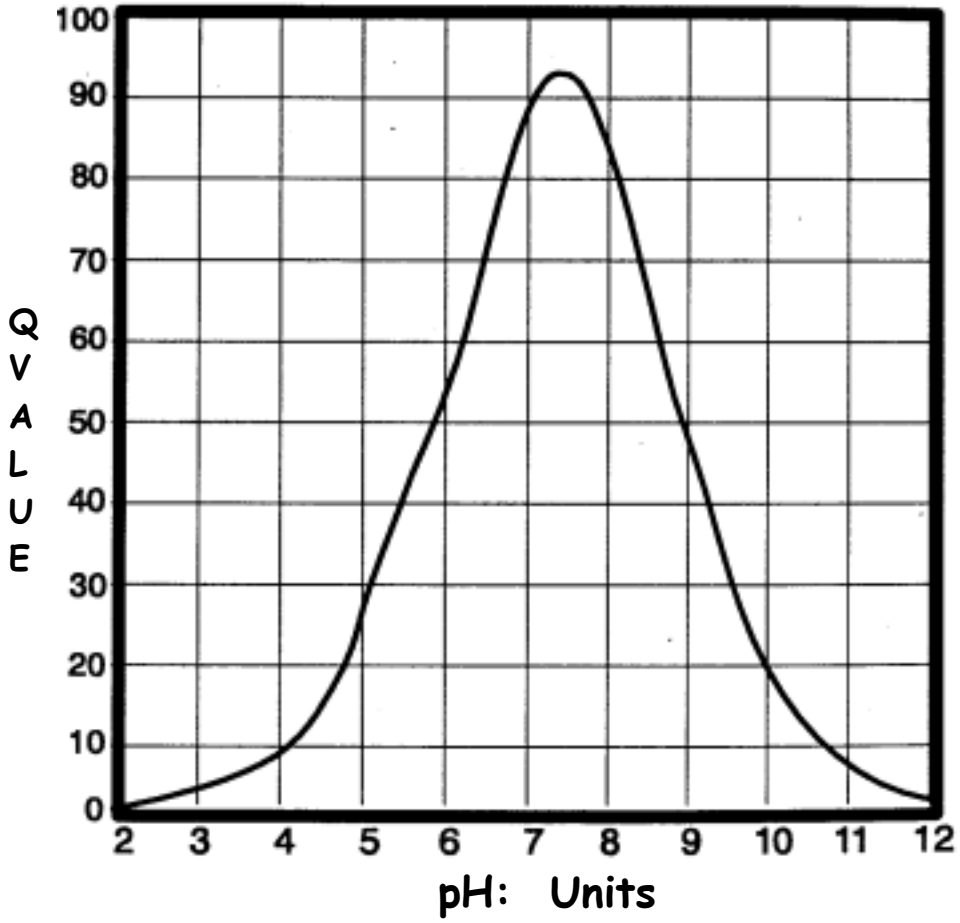
DO (% Saturation)	Q-Value
0	0
10	8
20	13
30	20
40	30
50	43
60	56
70	77
80	88
85	92
90	95
95	97.5
100	99
105	98
110	95
120	90
130	85
140	78
>140	50

E. coli Q-Values



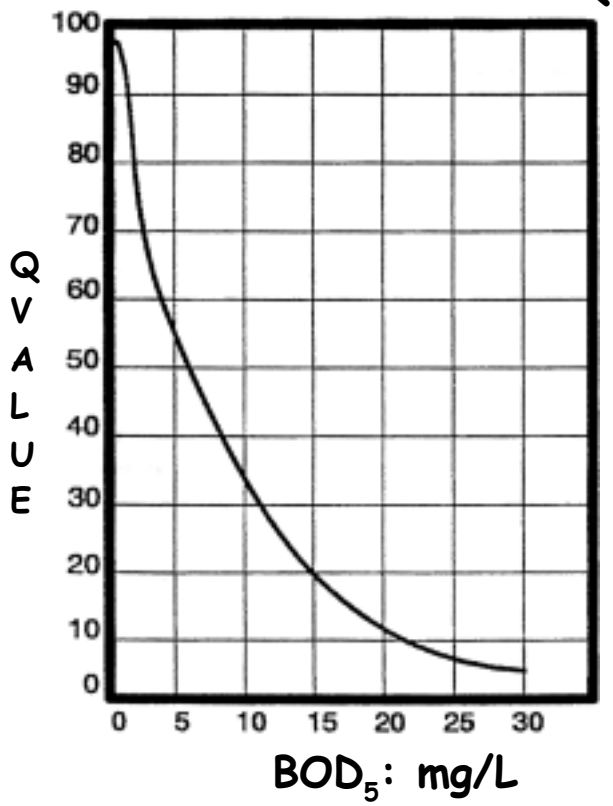
E.Coli (colonies/100mL)	Q-Value
0-1	98
2	89
5	80
10	71
20	63
50	53
100	45
200	37
500	27
1,000	22
2,000	18
5,000	13
10,000	10
20,000	8
50,000	5
100,000	3
>100,000	2

pH Q-Values



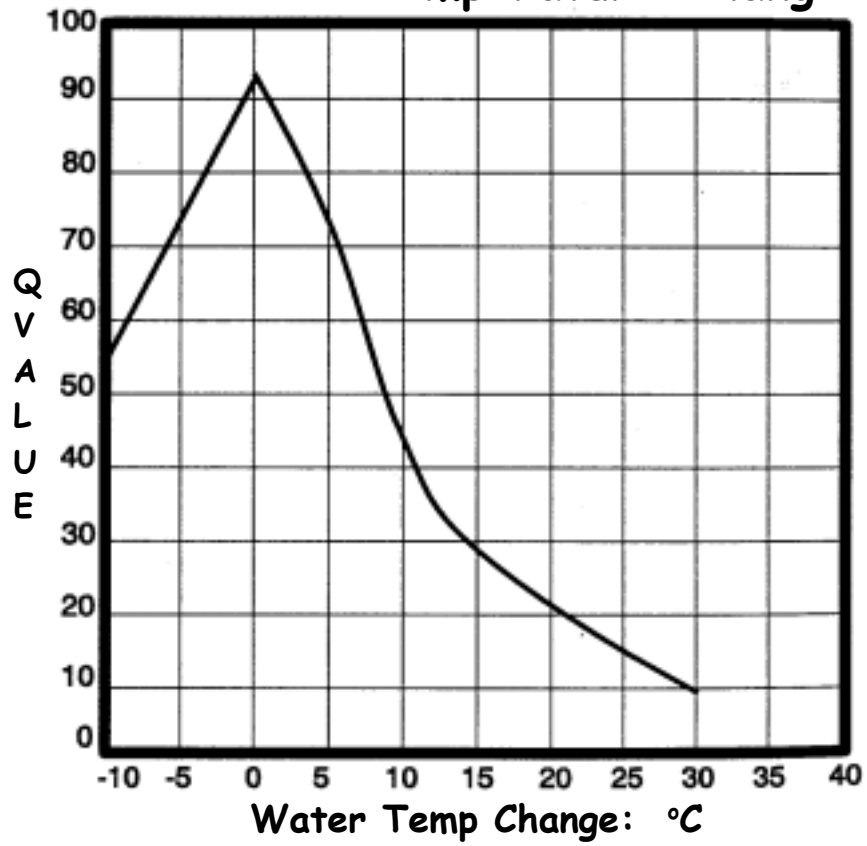
pH (units)	Q-Value
<2	0
2	2
3	4
4	8
5	24
6	55
7	90
7.2	92
7.5	93 (max)
7.7	90
8	82
8.5	67
9	47
10	19
11	7
12	2
>12	0

BOD5 Q-Values



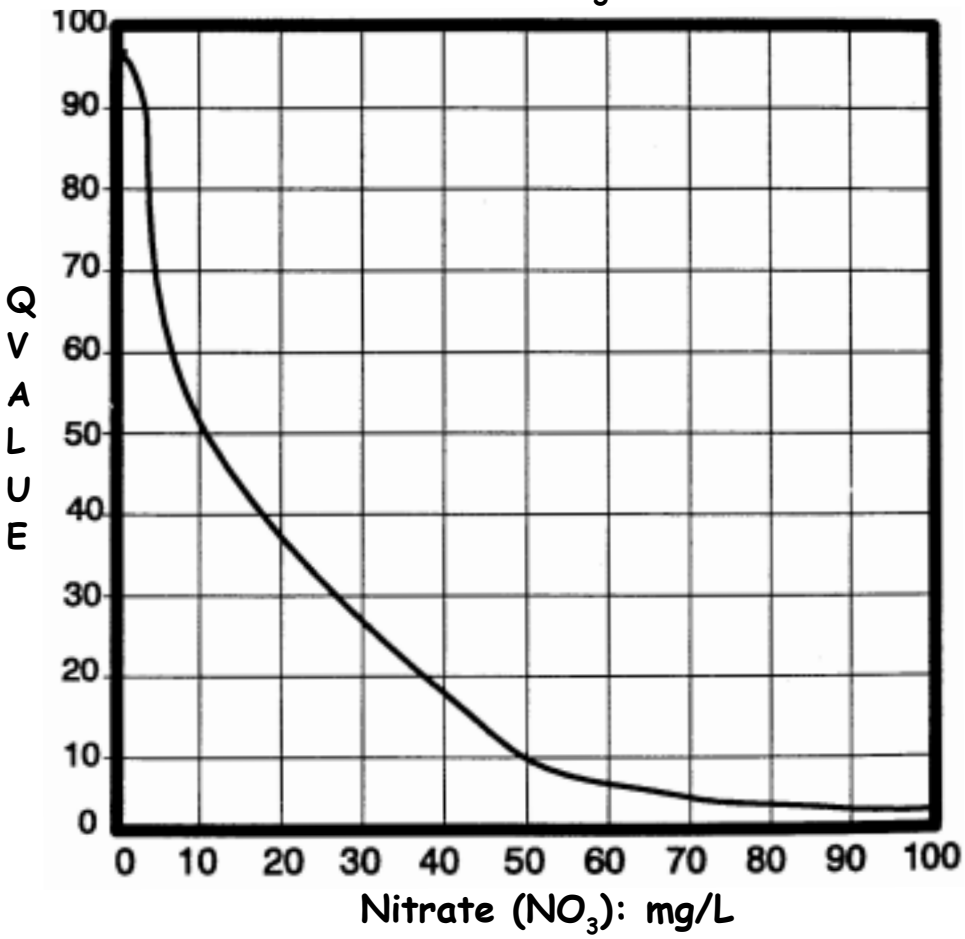
DO (% Saturation)	Q-Value
0	0
10	8
20	13
30	20
40	30
50	43
60	56
70	77
80	88
85	92
90	95
95	97.5
100	99
105	98
110	95
120	90
130	85
140	78
>140	50

Temperature Change Q-Values



Change in Temp. (°C)	Q-Value
-10	56
-7.5	63
-5	73
-2.5	85
-1	90
0	93 (max)
1	89
2.5	85
5	72
7.5	57
10	44
12.5	36
15	28
17.5	23
20	21
22.5	18
25	15
27.5	12
30	10

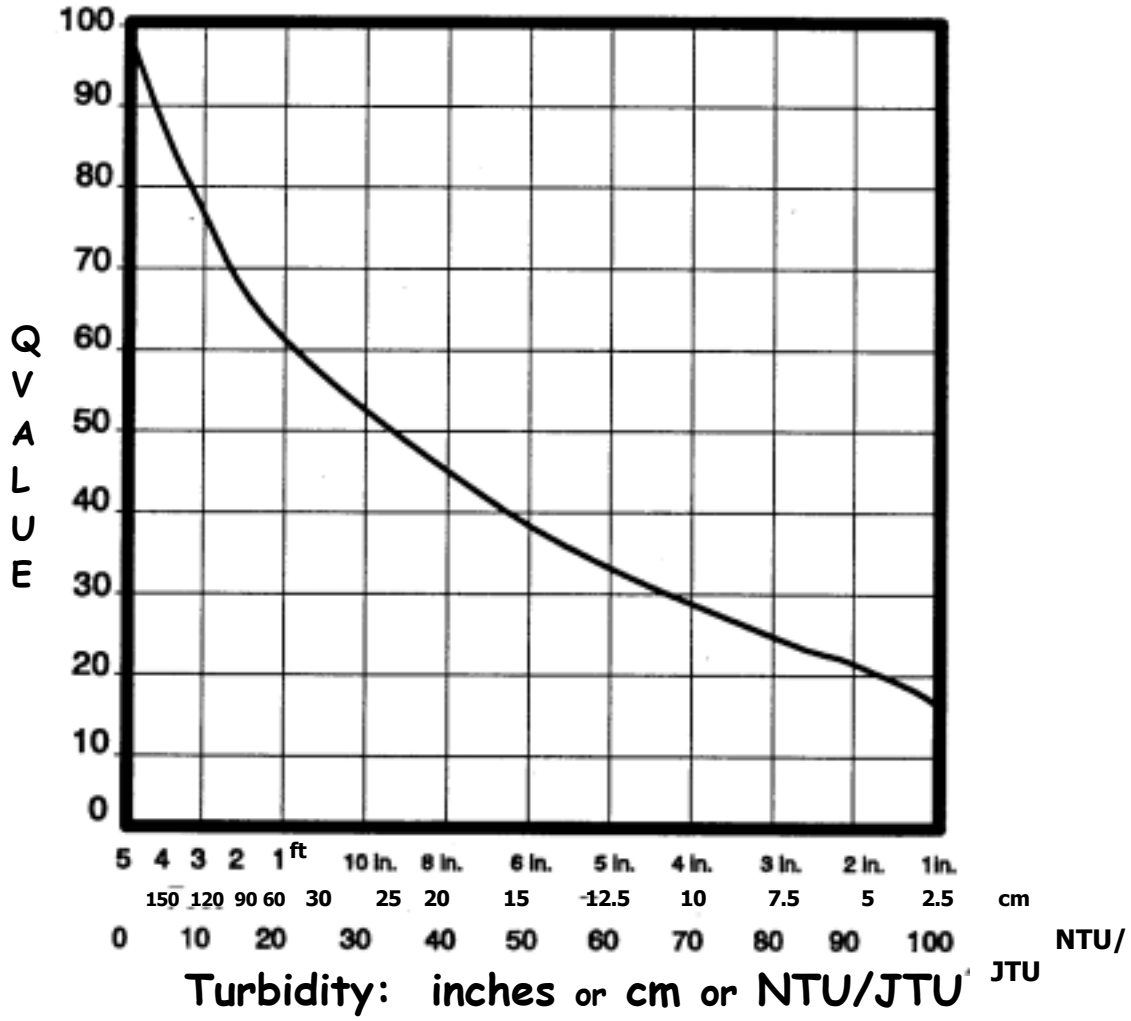
Nitrate (NO_3) Q-Values



Nitrate-N (mg/L NO_3-N)	Q-Value
0	98
0.25	97
0.5	96
0.75	95
1	94
1.5	92
2	90
3	85
4	70
5	65
10	51
15	43
20	37
30	24
40	17
50	7
60	5
70	4
80	3
90	2
100	1
>100	1

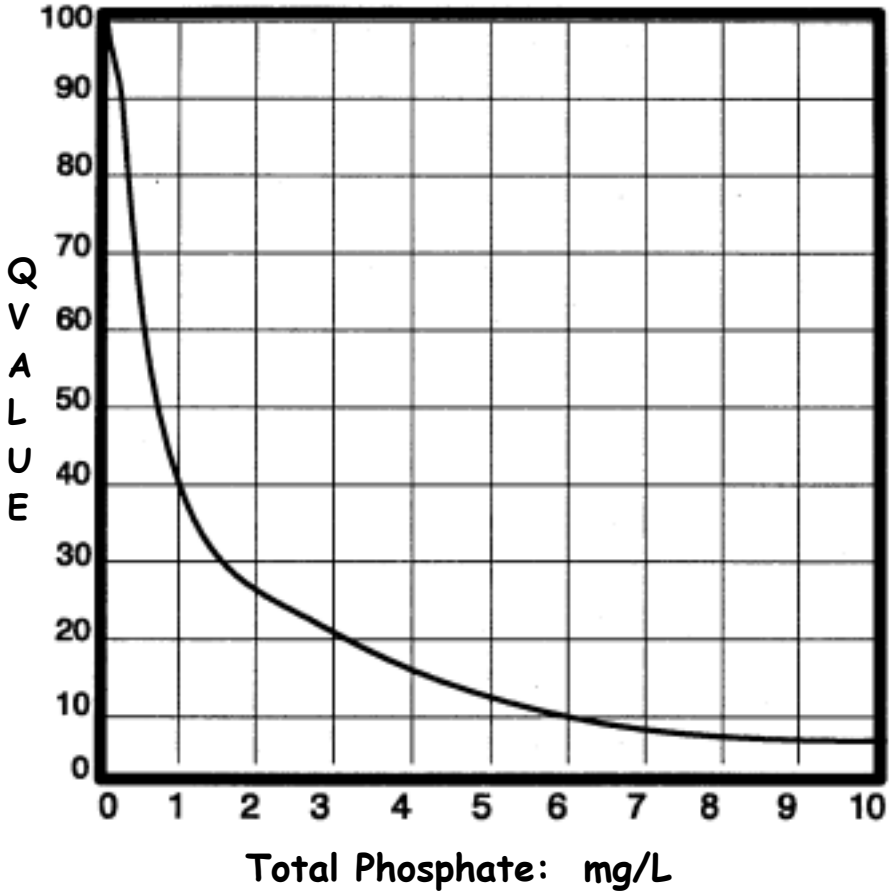
Turbidity Q-Values

Transparency (cm)	Turbidity (NTU)	Q-Value
Reading from Tube	Use in Database	
150	0	97
120	5	84
90	10	76
>60 (turb tube)	<15 (turb tube)	70
60	15	68
30	20	62
27.5	25	57
25	30	53
22.5	35	48
20	40	45
15	50	39
12.5	60	34
10	70	28
7.5	80	25
5	90	22
2.5	100	17
<2.5	>100	5



The Total Phosphate Q-value graph and table are provided for your general information. A Total Phosphate result can not be obtained using the methods provided in this manual.

Total Phosphate (PO_4) Q-Values



Total Phosphate (mg/L P)	Q-Value
0	99
0.05	98
0.1	97
0.2	95
0.3	90
0.4	78
0.5	60
0.75	50
1	39
1.5	30
2	26
3	21
4	16
5	12
6	10
7	8
8	7
9	6
10	5
>10	2

REMEMBER:

There are no Q-value charts or tables for Orthophosphate or Nitrite (NO_2).

Appendix E

Glossary

A

acid mine drainage: Waters of low pH (less than 6) from mining areas.
algae: Small plants which lack roots, stems, flowers, and leaves; living mainly in water and using the sun as an energy source.
alkalinity: A measurement of water's ability to neutralize acid.
aquatic habitat: All of the areas in a stream, lake or wetland that are occupied by an organism, population or community.
aquifer: Any geological formation containing water, especially one that supplies water for wells, springs, etc.

B

banks: The portion of the stream channel which restricts the movement of the water out of the channel during times of normal water depth. This area of the stream is characterized as being the exposed terrestrial areas on either side of the stream.
benthic: An adjective which describes all things associated with the bottom, or sediments of a stream.
bedrock: Unbroken solid rock, overlain in most places by soil or rock fragments.
biochemical oxygen demand (BOD): An empirical test in which standardized laboratory procedures measure the oxygen required for the biochemical degradation of organic material, and the oxygen used to oxidize inorganic materials, such as sulfides and ferrous iron.

C

channelization: The straightening of a stream or the dredging of a new stream channel to which the stream is diverted. A channelized stream is straight with little or no meanders.
class: A taxonomic rank which falls under the taxonomic rank of Order.
cobble streambed: A watercourse predominately lined with naturally rounded stones, rounded by the water's action. Size varies from a hen's egg to that used as paving stones.
complete metamorphosis: The type of insect development that includes four stages; egg, larva, pupa, adult.
conservation practice: An engineered structure or management activity that eliminates or reduces an adverse environmental effect of a pollutant and conserves soil, water, plant, or animal resources.

D

drainage basin: The total land area draining to any point in a stream. A drainage basin is composed of many smaller watersheds.
Dissolved Oxygen (DO): The amount of oxygen dissolved in water. Generally, proportionately higher amounts of oxygen can be dissolved in colder waters that in warmer waters.

E

ecology: The relationship between living things and their environments or the study of such relationships.
effluent: A discharge of partially or completely treated pollutants into the environment; generally used to describe discharge into the water.
emergent plants: Plants rooted in the bottom of the watercourse, that rise above the water surface.
erosion: The wearing away of the land surface by wind or water.
eutrophic: A highly productive water body, can be caused or accelerated by the input of large amounts of nutrients from human sources.
eutrophication: Natural eutrophication is the process of lake aging. Cultural eutrophication occurs when nutrients are added from agricultural runoff, sewage, or other sources.
Escherichia coli (E. Coli): A bacterium of the intestines of warm-blooded organisms, including humans, that is used as an indicator of water pollution for disease producing organisms.

F

floodplain: An area on both sides of a stream where flood waters spread out during high rains. The surface may appear dry for most of the year, but it is generally occupied by plants that are adapted to wet soils.

fecal coliform bacteria: The portion of the coliform group which is present in the gut or feces of warm-blooded animals. The presence of fecal coliform bacteria in water is an indication of pollution and potential human health problems.

food chain: A transfer of energy in a sequence of organisms (algae, fish, etc.) in a community in which each member of the chain feeds on the member below it.

H

habitat: The area in which an organism lives.

herbaceous vegetation: Plants having a stem that remains soft and succulent during the growing, not woody.

I

incomplete metamorphosis: The type of insect development that consists of three stages; egg stage, a nymph stage and an adult stage.

indicator organism: Organisms which respond predictably to various environmental changes, and whose presence or absence, and abundance, are used as indicators of environmental conditions.

inorganic: Any compound not containing carbon.

intermittent stream: A watercourse that flows only at certain times of the year, receiving water from springs or surface sources; also, a watercourse that does not flow continuously, when water losses from evaporation or seepage exceed available stream flow.

invertebrate: An organism without a backbone.

J

JTU's - Jackson Turbidity Units: a unit of measurement commonly used in electronic turbidity meters that indicate how far light can penetrate into a water sample before the cloudiness of the sample cuts the light. Similar to NTU's or Nephelometer Turbidity Unit.

L

lake: A body of fresh or salt water of considerable size, whose open-water and deep-bottom zones (no light penetration to the bottom) are large compared to the shallow-water (shoreline zone, which has light penetration to its bottom.

M

macroinvertebrates: Animals lacking backbones that are large enough to be visible without the aid of a microscope.

meanders: Sinuosity, or snake-like curving of a natural stream channel.

metamorphose: To change into a different form, such as from an insect pupa to an adult.

methemoglobinemia: The presence of methemoglobin in the blood, making the blood useless as a carrier of oxygen. Methemoglobin, a compound closely related to oxyhemoglobin, is found in the blood following poisoning by certain substances, such as nitrate. Young babies, both human and animal, are particularly susceptible to methemoglobinemia, leading to a condition known as "blue baby" which if untreated can cause death.

mollusk: Soft-bodied (usually hard-shelled) animals such as clams or mussels.

N

nitrogen: A limiting nutrient for the aquatic environment. Nitrogen is considered to be limiting because it is needed by the plants and animals in the stream in moderate amounts. When present in higher amounts, such as large amounts of fertilizer runoff from local farm fields, large algal blooms occur which cause a depletion of dissolved oxygen.

nonpoint source pollution: A type of pollution whose source is not readily identifiable as any one particular point, such as pollution caused by runoff from streets and agricultural land.

nutrient: Any substance which is necessary for growth of living things.

nymph: A juvenile, wingless stage of an insect.

NTU - Nephelometer Turbidity Units: a unit of measurement commonly used in electronic turbidity meters that indicate how far light can penetrate into a water sample before the cloudiness of the sample cuts into the light. Similar to Jackson Turbidity Units.

O

order: Taxonomic grouping of related families of organisms.
organic material: Any compound containing carbon.

P

pathogenic: Capable of causing disease.
pH: The measurement of acidity or alkalinity on a scale of 0 - 14. A pH of 7 is neutral, less than 7 is acidic, and more than 7 is alkaline (basic).
phosphorus: An essential plant nutrient that, in excessive quantities, can contribute to the eutrophication of water bodies.
photosynthesis: Process by which green plants use sunlight to produce food.
perennial stream: A watercourse that flows continuously throughout the year and whose upper surface generally stands lower than the water table in the area adjacent to the watercourse.
pollution sensitive organisms: Those organisms which cannot withstand the stresses applied on the aquatic environment by pollution.
pollution tolerant organisms: Those organisms which can withstand many of the stresses applied to an aquatic environment by pollution.
point source pollution: Pollutants originating from a "point" source, such as a pipe, vent, or culvert.
pond: A body of fresh or salt water, smaller than a lake, and where the shallow-water zone (light penetration to its bottom) is relatively large compared to the open water and deep bottom (no light penetration to the bottom).
pools: In a watercourse, an area often following a rapids (riffle), which is relatively deep with slowly moving water compared to the rapids.
pupa: The stage of an insect in which it is enclosed in a protective case while changing from larva to an adult.

R

riffle: In a watercourse, an area often upstream of a pool, which is relatively shallow with swiftly moving water compared to the pool.
riprap: Any material (such as concrete blocks, rocks, car tires or log pilings) which are used to protect a stream bank from erosion.
riparian zone: An area, adjacent to and along a watercourse, which is often vegetated and constitutes a buffer zone between the nearby lands and the watercourse.
runoff: Water from rain, snowmelt, or irrigation that flows over the ground surface and runs into a water body.

S

sediment: Soil, sand, and minerals washed from land into waterways.
sedimentation: The process by which soil particles (sediment) enter, accumulate and settle to the bottom of a waterbody.
septic odor: The sulfur (rotten egg) smell produced by the decomposition of organic matter in the absence of oxygen.
sewage: The organic waste and wastewater produced by residential and commercial establishments.
sewage treatment plant: A facility designed to remove organic pollutants from wastewater.
silt: Fine particles of soil or rock that can be picked up by air or water and deposited as sediment.
siltation: The process of silt settling out of the water and being deposited as sediment.
submergent rooted plant: An aquatic plant whose roots are in the watercourse's bottom with the upper part of the plant submerged below the surface of the water.
substrate: The surface upon which an organism lives or is attached.
species: A unit of classification for a group of closely related individuals.
stream bed: The bottom of a stream where the substrate and sediments lay.
stream depth: A measurement of the depth of a stream from the water's surface to the stream bed.
stream flow: The amount of water moving in a stream in a given amount of time.

T

tolerant species: An organism that can exist in the presence of a certain degree of pollution.
topographic map: A map representing the surface features of a particular area.
total coliform bacteria: A group of bacteria that are used as an indicator of drinking water quality. The presence of total coliform bacteria indicates the possible presence of disease-causing bacteria.

total suspended solids: Whole particles carried or suspended in the water, such as silt, sand or small algae or animals, that cause a green or brown color in the water. These substances can be filtered out of the water and weighed.
total dissolved solids: Substances that are dissolved in the water which can color the water brown or yellow. Tannic acids that leach from tree roots or from decomposing leaves can color the water brown to black due to dissolved chemicals. This color does not disappear by filtering the water.
toxicity: A measurement of how poisonous or harmful a substance is to plants and animals.
turbidity: The presence of sediment in water, making it unclear, murky or opaque.
trend data: Data or measurements of a stream system which will show how particular characteristics changed over time.

U

urban runoff: Water which has drained from the surface of land which is used for urban uses, such as paved roads, subdivisions an parking lots.

W

wastewater: Water carrying unwanted material from homes, farms, businesses and industries.
water quality: The condition of the water with regard to the presence or absence of pollution.
watershed: The entire surface drainage area that contributes water to a stream or river. Many watersheds which drain into a common river make a drainage basin.
woody vegetation: Plants having a stem or trunk that is fibrous and rigid.

APPENDIX F

Other Resources*

WATER QUALITY MONITORING RESOURCES

Field Manual for Global Low-Cost Water Quality Monitoring. 2nd ed. 1997. M.K. Mitchell and W.B. Stapp. 334 pp. $19.95. Illustrated guide to methods for conducting most common water quality monitoring tests, including turbidity, phosphorus, nitrogen, fecal coliforms, insect collection, and watershed land use analysis. This book is used by many school and volunteer groups in Indiana as standard methods for water testing. ISBN# 0-7872-2375-1 Available from: Kendall Hunt Publishing Co. P.O. Box 1840, Dubuque, IA, 52004.Tel. (800) 338-8309.

Volunteer Stream Monitoring: A Methods Manual. EPA 440/4-91-002, 1991, 124 pp., and "National Directory of Volunteer Environmental Monitoring Programs" EPA 841-B-94-001, 1994, 531 pp. Methods for monitoring lake conditions, including algae, aquatic plants, dissolved oxygen, and other characteristics. Listing of groups involved in water quality monitoring. Available from: Clean Lakes Program, Assessment and Watershed Protection Division (WH-553), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460. Free!

Streamkeeper's Field Guide: Watershed Inventory and Stream Monitoring Methods. T. Murdoch and M. Cheo. 1996. $29.95 Adopt-A-Stream Foundation, Everett, WA. 296 pp. ISBN 0-9652109-0-1. Excellent manual on citizen assessment and monitoring of streams and watersheds. Available from: The Adopt-A-Stream Foundation, 600 128th Street SE, Everett, WA 98208. Tel. (206) 316-8592. www.streamkeeper.org (The foundation also has guides on wetland assessment and several beautiful posters on streams, wetlands, and salmon.)

Pond and Brook: A Guide to Nature in Freshwater Environments. M.J. Caduto, 1990. Excellent introduction to aquatic biology, from wetlands and deep lakes to streams and vernal ponds, for the amateur naturalist, including hands-on projects and activities. ISBN 0-87451-509-2. $22.95. Available from: Patricia Ledlie Bookseller, Inc., PO Box 90, Buckfield, Maine 04220. ledlie@ledlie.com Tel or FAX (207) 336-2778 (and at most larger bookstores).

Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish. EPA/440/4-89-001. & **Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters.** EPA/600/4-90/030. 256 pp. These two publications explain the standard methods used by EPA for sampling insects and fish in streams. Available from: Clean Lakes Program, Assessment and Watershed Protection Division (WH-553), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460, Tel. (513) 569-7562.

The Volunteer Monitor. **FREE National newsletter of water quality monitoring.** Available from: Volunteer Monitor Distribution Office, 211A Chattanooga St, San Francisco, CA 94114-3411, skvigil@yahoo.com Tel. (415) 695-0801

Protecting Our Watersheds. Comprehensive action package that gives educators a step-by-step process to guide young people in improving the health of their water resources. $65 (#POW 951) Available from: Earth Force, 1908 Mount Vernon Ave, 2nd Floor, Alexandria, VA 22301, greensales@earthforce.org, Tel. (703) 519-6877.

Healthy Water Healthy People. Available from Healthy Water, Healthy People, 201 Culbertson Hall, MSU, PO Box 170575, Bozeman, MT 59717-0575, healthywater@montana.edu, Tel. (866) 337-2486, http://www.healthywater.org.

Pond and Stream Safari. 4-H Leader's Guide 147L24. Cornell University Extension, Tel. (607) 255-2080

Illinois Rivers Curriculum. ISBN 0-201-49370-5. $23.95. Available from: Rivers Project, Southern Illinois University, Box 2222, Edwardsville, IL 62026-2222, rivers@siue.edu, http://www.siue.edu/OSME/river, Tel. (618) 650-3788

Getting in Step: A Guide to Effective Outreach in Your Watershed. A manual to help address public perceptions, promote management activities, and inform or motivate stakeholders. It also provides some of the tools to develop and implement an effective watershed outreach plan. C183-9800. $10.00. Available from: The Council of State Governments, Tel. (800) 800-1910.

All prices subject to change.

Water Studies for Younger Folks: A Water Activities Manual for Elementary School Students. Cromwell, Mare, E. Delhagen, J. Hartman, R. Reese, M. Zweizig. $10.95 (Cat#EF 400) Earth Force's Global Rivers Environmental Education Program, Alexandria, VA – www.earthforce.org

The Clean Water Act: An Owner's Manual. ISBN 1-930407-02-5. $25.00. Available from: River Network, 520 SW 6th Ave., Suite 1130, Portland, OR 97204, info@rivernetwork.org, Tel. (503) 241-9256.

Data to Information: A Guidebook for Coastal Volunteer Water Quality Monitoring Groups in New Hampshire and Maine. Dates, Geoff and Jeff Schloss Oct 1998. University of Maine Cooperative Extension and University of Maine/ New Hampshire Sea Grant Extension, Tel. (207)832-0377 www.umext.maine.edu or esp@umce.umext.maine.edu

Ready, Set, Present! A Data Presentation Manual for Volunteer Water Quality Monitoring Groups. Schoen, Jerry, M. Walk, M. Tremblay. Massachusetts Water Watch Partnership, University of Massachusetts, Dec. 1999. (413) 545-2842 www.umass.edu/tei/mwwp jschoen@tei.umass.edu

Stream Ecology Resources

Entering the Watershed: A New Approach to Save America's River Ecosystems. B. Doppelt, M. Scurlock, C. Frissell, and J. Karr. 1993. Island Press. 462 pp. ISBN 1-55963-275-5. Describes current and proposed laws and regulations for protection of stream resources. Available from: Island Press, Box 7, Covelo, CA 95428. Tel. (800) 828-1302. (Catalogs from Island Press include an excellent listing of unusual books on environmental issues.)

Stream Ecology: Structure and Function of Running Waters. J.D. Allen. 1995. Chapman & Hall, New York, NY. 388 pp. ISBN 0-412-35530-2. Technical description of the scientific concepts guiding research in stream ecosystems. Available from: Patricia Ledlie Bookseller, Inc., Buckfield, Maine 04220. Tel. or FAX (207) 336-2778.

Riparian Landscapes. G.P. Malanson. 1993. Cambridge University Press, New York, NY. 296 pp. ISBN 0-521-38431-1. Valuable reference on options and solutions for managing riparian habitat. Available from: Patricia Ledlie Bookseller, Inc., Buckfield, Maine 04220. Tel. or FAX (207) 336-2778.

IDENTIFICATION KEYS

Aquatic Entomology: The Fishermen's and Ecologists' Illustrated Guide to Insects and Their Relatives. W.P. McCafferty. Jones and Bartlett. 448 pp. ISBN 0-86720-017-0. $55. Illustrated keys to the majority of the aquatic insect species that are found in Indiana and useful ecological information on each species. McCafferty is a professor at Purdue University, so many of the species are common to the midwest. Available from: Jones and Bartlett Publishers, Inc., 20 Park Plaza, Boston, MA 02116. Tel. (800) 832-0034.

A Guide to the Freshwater Invertebrates of North America. J. Reese Voshell, Jr. 2002. McDonald & Woodward Publishing Company. 442pp. ISBN 0-939923-87-4. $29.95. Available from: McDonald & Woodward Publishing Company, 431-B East College Street, Granville, OH 43023, mwpubco@mwpubco.com, Tel. (800) 233-8787.

Macroinvertebrate Identification Cards. Item # ICS. $4.00. Available from: Illinois Natural History Survey, 607 East Peabody Drive, Champaign, IL 61820, Tel. (217) 333-6833

Macroinvertebrate Flash Cards – Catalog # 5882-SA1. $35.00. Available from: Earth Force/GREEN, 1908 Mount Vernon Ave, 2nd Floor, Alexandria, VA 22301, greensales@earthforce.org, Tel. (703) 519-6877.

Pond Life: A Golden Guide. George K. Reid. 2001. St Martin's Press. 160pp. ISBN 1-58238-130-5. $6.95. Available from: St. Martin's Press, 175 Fifth Ave., New York, NY 10010, www.stmartins.com, Tel. (888) 330-8477.

Freshwater Macroinvertebrates of Northeastern North America. B.L. Peckarsky, et al. Cornell University Press. 442 pp. $24. Keys to the level of genus for insects, snails, clams, crayfish, leeches, and worms that include most Indiana species. Available from: Patricia Ledlie Bookseller, Inc., Buckfield, Maine 04220. Tel. or FAX (207) 336-2778.

The Fishes of Missouri. W.L. Pflieger. Missouri Department of Conservation. 342 pp. Illustrated keys to the majority of the fish species that are found in Indiana and useful ecological information on each species. Available from: Missouri Department of Conservation Tel. (800) 781-1989.

Fishes of Wisconsin. G.C. Becker. University of Wisconsin Press. ISBN 0-299-08790-5. 1052 pp. Extensive information and illustrated keys to nearly all fish that could be found in Indiana. $75. Available from: Patricia Ledlie Bookseller, Inc., Buckfield, Maine 04220. Tel. or FAX (207)336-2778.

Aquatic Plant Identification Deck. University of Florida. Sixty-seven laminated "cards" riveted together with a clear photograph of the aquatic plant on the front and general information about identification and habitat of the species on the back. Some tropical species are not relevant, but most of the species are found in Indiana. $8. Available from: University of Florida, Tel. (904) 392-1799 or (904) 392-1764.

How to Know the Aquatic Plants. G.W. Prescott. 158 pp. ISBN 0-697-04775-X (spiral bound) or 0-697-04774-1 (cloth). $20. and **How to Know the Freshwater Algae**. G.W. Prescott. 293 pp. ISBN 0-697-04754-7. $20. Illustrated keys to the majority of the algae and aquatic plant species in the US. Order both from larger book stores.

Field Guide to Freshwater Mussels of the Midwest. K.S. Cummings and C.A. Mayer. 1992. Illinois Natural History Survey. 194 pp. ISBN: 1-882932-00-5. Illustrated keys to the majority of the mussel species in the Midwest. Includes color photos of all species. Available from: Illinois Natural History Survey, Natural Resources Building, 607 East Peabody Drive, Champaign, Illinois 61820.

LAKE MANAGEMENT RESOURCES

Life on the Edge...Owning Waterfront Property. 1994. 95 pp. Gives advice on selecting waterfront property and stewardship responsibilities of shoreline property owners in protection of water quality, open space, and natural beauty. Sections on aquatic plants and federal, state (Wisconsin), and local laws pertaining to waterfront property. Available from: University of Wisconsin-Extension, Lake Management Specialists, College of Natural Resources, University of Wisconsin, Stevens Point, WI 54481, Tel. (715) 346-2116.

A Primer on Limnology. Second Edition. 1992. B.A. Monson. 54 pp. Introduction to physical, biological, and chemical structure of lakes, lake classification, human influences, and process for organizing a lake study. Available from: Water Resources Research Center, College of Natural Resources, University of Minnesota, Room 302, 1518 Cleveland Avenue, N., St. Paul, MN 55108.

Lake Smarts: The First Lake Maintenance Handbook. 1993. S. McComas. 215 pp. Guide to affordable projects to help clean up, improve, and maintain lakes and ponds, including aquatic plant control, sediment, on-site waste disposal, undesirable fish, and waterfowl management. Developed for Midwestern states. $18.95 paperback. Available from: Terrene Institute, 1717K Street, N.W., Suite 801, Washington, D.C. 20006-1504, Tel. (202) 833-8317.

Volunteer Lake Monitoring: A Methods Manual. EPA 440/4-91-002, 1991, 124 pp., and "National Directory of Volunteer Environmental Monitoring Programs" EPA 841-B-94-001, 1994, 531 pp. Methods for monitoring lake conditions, including algae, aquatic plants, dissolved oxygen, and other characteristics. Listing of groups involved in water quality monitoring. Available from: Clean Lakes Program, Assessment and Watershed Protection Division (WH-553), U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460.

Lake Leaders Handbook. 1995. Contains the "largest collection of specialized lake management information for citizen leaders ever brought together in one document" to support responsibilities of lake organization leadership, including topics on formation and operation of lake associations, motivation of volunteers, planning for the lake future, understanding government (!), running a proper meeting, insurance coverage, grants, educational programs, lake management, land use regulations, directory of lake managers, and publications list. Available from: Robert Korth, College of Natural Resources, University of Wisconsin, 2100 Main Street, Stevens Point, WI 54481-3897.

Restoration of Aquatic Ecosystems. National Research Council, 1992, 552 pp. Technical reference on restoration of lakes, rivers, streams, and wetlands. ISBN 0-309-04534-7. Available from: National Academy Press, National Academy of Sciences, Washington, D.C.

WETLAND RESOURCES

Wetlands. W.J. Mitsch and J.G. Gosselink. 1993. Van Nostrand Reinhold, New York, NY. 722 pp. ISBN 0-442-00805-8. Very comprehensive textbook on function and management of wetlands for students and land managers. Available from: Patricia Ledlie Bookseller, Inc., Buckfield, Maine 04220. Tel. or FAX (207)336-2778.

Treatment Wetlands. R.H. Kadlec and R.L. Knight. 1996. Lewis Publishers, New York, NY. 893 pp. ISBN 0-87371-930-1. Very comprehensive textbook on design and use of wetland systems for treatment of wastewater and nonpoint source pollution.

APPENDIX G

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APPENDIX H

Extra Data Sheets

Citizens Qualitative Habitat Evaluation Index
Stream Flow Calculation Worksheet
Stream Site Map
Chemical Monitoring Work Sheet
Chemical Monitoring Data Sheet
Biological Monitoring Data Sheet
Macroinvertebrate Identification Key

www.HoosierRiverwatch.com

Date: _____

Citizens Qualitative Habitat Evaluation Index

CQHEI Total: _____

Vol ID: _____ Site ID: _____ River and Watershed: _____

I. Substrate (Bottom Type) — Score: _____

a) Size

- ☐ 14 pt — Mostly Large (Fist Size or Bigger)
- ☐ 10 pt — Mostly Medium (Smaller than Fist, but Bigger than Fingernail)
- ☐ 6 pt — Mostly Small (Smaller Than Fingernail, but Still Coarse, or Bedrock)
- ☐ 0 pt — Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky)

b) "Smothering"

- ☐ NO 5 pt — Are Fist Size and Larger Pieces Smothered By Sands/Silts?
- ☐ YES 0 pt — Symptoms: Hard to Move Large Pieces, Often Black on Bottom with Few Insects

c) "Silting"

- ☐ NO 5 pt — Are Silts and Clays Distributed Throughout Stream?
- ☐ YES 0 pt — Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

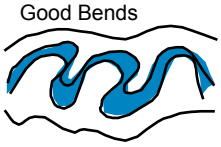
II. Fish Cover (Hiding Places) - Add 2 Points For Each One Present — Score: _____

- ☐ 2 pt — Underwater Tree Roots (Large)
- ☐ 2 pt — Underwater Tree Rootlets (Fine)
- ☐ 2 pt — Boulders
- ☐ 2 pt — Backwaters, Oxbows or Side Channels
- ☐ 2 pt — Downed Trees, Logs, Branches
- ☐ 2 pt — Shallow, Slow Areas for Small Fish
- ☐ 2 pt — Water Plants
- ☐ 2 pt — Deep Areas (Chest Deep)
- ☐ 2 pt — Undercut Banks
- ☐ 2 pt — Shrubs, Small Trees that Hang Close Over the Bank

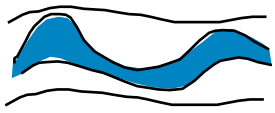
III. Stream Shape and Human Alterations — Score: _____

a) "Curviness" or "Sinuousity" of Channel

- ☐ 8 pt — 2 or More Good Bends



- ☐ 6 pt — 1 or 2 Good Bends



- ☐ 3 pt — Mostly Straight Some "Wiggle"

- ☐ 0 pt — Very Straight

b) How Natural Is The Site?

- ☐ 12 pt — Mostly Natural
- ☐ 9 pt — A Few Minor Man-made Changes (e.g., a bridge, some streambank changes)
- ☐ 6 pt — Many Man-made Changes, but still some natural conditions left (e.g., trees, meanders)
- ☐ 0 pt — Heavy, Man-made Changes (e.g., leveed or channelized)

IV. Stream Forests & Wetlands (Riparian Area) & Erosion — Score: _____

a) Width of Riparian Forest & Wetland - Mostly:

- ☐ 8 pt — Wide (Can't Throw A Rock Through/ Across It)
- ☐ 5 pt — Narrow (Can Throw A Rock Through/ Across It)
- ☐ 0 pt — None

b) Land Use - Mostly:

- ☐ 5 pt — Forest/Wetland
- ☐ 4 pt — Shrubs
- ☐ 3 pt — Overgrown Fields
- ☐ 2 pt — Fenced Pasture
- ☐ 2 pt — Park (Grass)
- ☐ 2 pt — Conservation Tillage
- ☐ 1 pt — Suburban
- ☐ 1 pt — Row Crop
- ☐ 0 pt — Open Pasture
- ☐ 0 pt — Urban/ Industrial

c) Bank Erosion - Typically:

- ☐ 4 pt — Stable Hard or Well-Vegetated Banks
- ☐ 2 pt — Combination of Stable and Eroding Banks
- ☐ 0 pt — Raw, Collapsing Banks

d) How Much of Stream is Shaded?

- ☐ 3 pt — Mostly
- ☐ 2 pt — Partly
- ☐ 0 pt — None

V. Depth & Velocity — Score: _____

a) Deepest Pool is At Least:

- ☐ 8 pt — Chest Deep
- ☐ 6 pt — Waist Deep
- ☐ 4 pt — Knee Deep
- ☐ 0 pt — Ankle Deep

b) Check ALL The Flow Types That You See (Add Points):

- ☐ 2 pt — Very Fast: Hard to Stand in the Current
- ☐ 3 pt — Fast: Quickly Takes Objects Downstream
- ☐ 1 pt — Moderate: Slowly Takes Objects Downstream
- ☐ 1 pt — Slow: Flow Nearly Absent
- ☐ 0 pt — None

VI. Riffles/Runs (Areas Where Current is Fast/Turbulent, Surface May Be Broken) — Score: _____

a) Riffles/Runs Are:

- ☐ 8 pt — Knee Deep or Deeper & Fast
- ☐ 6 pt — Ankle/Calf Deep & Fast
- ☐ 4 pt — Ankle Deep or Less & Slow
- ☐ 0 pt — Do Not Exist

b) Riffle/Run Substrates Are:

- ☐ 7 pt — Fist Size or Larger
- ☐ 6 pt — Smaller Than Fist Size, but Larger Than Fingernail
- ☐ 0 pt — Smaller Than Your Fingernails or Do Not Exist

Hoosier Riverwatch Stream Flow Calculation Worksheet

1. River Width (W)

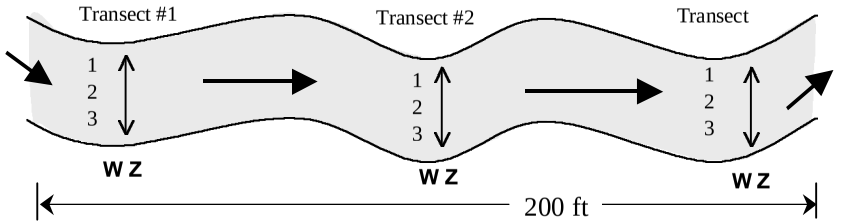
(One measurement at each transect.)

Transect #	Width (ft)
(1)	
(2)	
(3)	
Average Width (W)	

2. River Depth (Z)

(Three measurements along each transect.)

	Transect 1 (ft)	Transect 2 (ft)	Transect 3 (ft)	
(1)				
(2)				
(3)				
Average Depth (Z)				



3. Surface Velocity(V) = Length/Time

(Allow the object to attain velocity before timing it.)

	Length (ft)	Time (sec)	Velocity ft/sec
(1)			
(2)			
(3)			
		Average Velocity (V)	

Unit Conversions
1 in = 0.0833 ft
1 m = 3.281 ft

4. Stream Flow = Discharge (D)

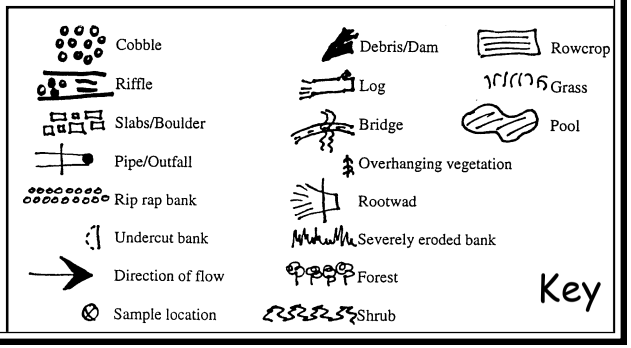
Avg. Width (W)		feet
Avg. Depth (Z)		feet
Avg. Velocity (V)		feet/sec
*(n) = 0.9 or 0.8		none
Discharge (D)		ft^3/s = (cfs)

Multiply W x Z x V x n = D

*n is a constant indicating roughness of substrate - use 0.9 for sandy, muddy bottom or bedrock; use 0.8 for gravel or rocky bottom

Convert measurements of feet + inches to 10^{ths} of feet. **Example: 10 ft + 4 in = 10.33 ft**. (Multiply 4 inches x 0.0833 feet/inch = 0.3332 ft. Add this to 10 feet = 10.33 feet.)

Stream Site Map



Chemical Monitoring Work Sheet

Date	
Time	
Stream Name and Site ID	
Air Temp °C	
Water Temp °C	
Lat °N	
Long °W	

Current Weather ☐ Clear/Sunny ☐ Overcast ☐ Showers ☐ Rain (Steady) ☐ Storm (Heavy)

Worst Weather in Past 48 hrs ☐ Clear/Sunny ☐ Overcast ☐ Showers ☐ Rain (Steady) ☐ Storm (Heavy)

	Units	Sample 1	Sample 2	Sample 3	Average
Dissolved Oxygen (DO)	% Saturation				
	mg/L				
Avg DO (original)	mg/L				
— **DO after 5 days**		—	—	—	—
BOD 5-day (difference)					
***E*. Coli Bacteria** *(purple/blue-violet colonies)*	colonies/ 100 mL				
General Coliforms *(pink/magenta colonies)*	colonies/ 100 mL				
pH	units				
Temp at Your Site	°C				
— **Upstream (1 mi) Temp**		—	—	—	—
Temperature Change					
Orthophosphate	mg/L				
Total Phosphate *(add acid and boil for 30 min)*	mg/L				
Nitrate (NO_3) *(after multiply by 4.4)*	mg/L				
Nitrite (NO_2) *(after multiply by 3.3)*	mg/L				
Transparency *(from Tube)*	cm				
Turbidity *(from chart – use in database entry)*	NTU				
Ammonia Nitrogen	mg/L				
Other _____					
Other _____					
Other _____					
Other _____					

CHEMICAL MONITORING DATA SHEET (WQI)

Date ____/____/____ (MM DD YY) Begin Time _____:_____ (am/pm) # Adults _____

End Time _____:_____ (am/pm) # Students _____

Certified Monitors' Names_____ Volunteer ID_____

Organization Name _____

Watershed Name _____ Watershed # __ __ __ __ __ __ __ __

Stream/River Name _____ Site ID _____

(Please do not abbreviate.) (Above ID numbers are required.)

Current Weather ☐ Clear/Sunny ☐ Overcast ☐ Showers ☐ Rain (Steady) ☐ Storm (Heavy)

Weather in Past 48 hrs. ☐ Clear/Sunny ☐ Overcast ☐ Showers ☐ Rain (Steady) ☐ Storm (Heavy)

WATER QUALITY INDEX (WQI)

You may perform as many of the following tests as you wish; however, at least 6 must be completed to obtain a Total Water Quality Index value. Divide the total of the *Calculation* column by the total of the *Weighting Factor* column to obtain the Water Quality Index rating.

Test Results		*Q-Value*		*Weighting Factor*		*Calculation*
	_____ mg/L					
Dissolved Oxygen	_____ % saturation	_____	X	**.18**	=	_____
***E.* coli**	_____ colonies/100mL	_____	X	**.17**	=	_____
pH	_____ units	_____	X	**.12**	=	_____
B.O.D. 5	_____ mg/L	_____	X	**.12**	=	_____
H_2O Temp Change	_____ change in°C	_____	X	**.11**	=	_____
Total Phosphate	_____ mg/L	_____	X	**.11**	=	_____
Nitrate (NO_3)	_____ mg/L	_____	X	**.10**	=	_____
Turbidity	_____ NTU's	_____	X	**.09**	=	_____

TOTALS _____ _____

Excellent	90 - 100%	Bad	25 - 49%
Good	70 - 89%	Very Bad	0 - 24%
Medium	50 - 69%		

WATER QUALITY INDEX RATING ☐

BIOLOGICAL MONITORING DATA SHEET

Date ____/____/____ (MM DD YY) Begin Time _____:_____ (am/pm) # Adults _____

End Time _____:_____ (am/pm) # Students _____

Certified Monitors' Names_____ Volunteer ID_____

Organization Name _____

Watershed Name _____ Watershed # __ __ __ __ __ __ __ __

Stream/River Name _____ Site ID _____

(Please do not abbreviate.) (Above ID numbers are required.)

Check Methods Used

- ☐ Kick Seine Net (3 times)
- ☐ D-Net (20 jabs or scoops)

Check Habitats Sampled

- ☐ Riffles
- ☐ Leaf Packs
- ☐ Undercut Banks
- ☐ Snags/Vegetation
- ☐ Sediment
- ☐ Other

POLLUTION TOLERANCE INDEX (PTI)

PT GROUP 1 *Intolerant*		PT GROUP 2 *Moderately Intolerant*		PT GROUP 3 *Fairly Tolerant*		PT GROUP 4 *Very Tolerant*	
Stonefly Nymph	_____	Damselfly Nymph	_____	Midges	_____	Left-Handed Snail	_____
Mayfly Nymph	_____	Dragonfly Nymph	_____	Black Fly Larvae	_____	Aquatic Worms	_____
Caddis Fly Larvae	_____	Sowbug	_____	Planaria	_____	Blood Midge	_____
Dobsonfly Larvae	_____	Scud	_____	Leech	_____	Rat-tailed Maggot	_____
Riffle Beetle	_____	Crane Fly Larvae	_____				
Water Penny	_____	Clams/Mussels	_____				
Right-Handed Snail	_____	Crayfish	_____				
# Of TAXA	_____	**# Of TAXA**	_____	**# Of TAXA**	_____	**# Of TAXA**	_____
Weighting Factors: **(x 4)**	_____	**(x 3)**	_____	**(x 2)**	_____	**(x 1)**	_____

23 or More	**Excellent**
17 - 22	**Good**
11 - 16	**Fair**
10 or Less	**Poor**

POLLUTION TOLERANCE INDEX RATING
(Add the final index values for each group.) ☐

Other Biological Indicators

- ☐ Native Mussels
- ☐ Zebra Mussels
- ☐ Rusty Crayfish
- ☐ Aquatic Plants
- _____ % Algae Cover
- _____ Diversity Index